## CLAIMS

1. Photon source comprising an electron cyclotron resonance (ECR) multicharged ion plasma source, the multicharged ions corresponding to several charge states of a first constituent (g1) inserted into a vacuum chamber (CH), and at least one charge state emitting photons with a wavelength $\lambda_o$ by de-excitation, wherein means set up a pressure gradient within the chamber (CH) of the first constituent (g1) and/or at least one second constituent (g2) different from the first constituent (g1), the pressure gradient being capable of creating an energy gradient of plasma electrons such that additional multicharged ions corresponding to at least one charge state of the first constituent (g1) and/or at least one charge state of the second constituent (g2) are created in the chamber, the additional multicharged ions emitting photons with a wavelength equal to approximately $\lambda_o$ by de-excitation.

2. Photon source according to claim 1, wherein the means of setting up a pressure gradient include a first diaphragm (D1) located on a first side of the chamber and a second diaphragm (D2) located on a second side of the chamber opposite the first side, in which there is an aperture through which photons are extracted from the photon source.

3. Photon source according to claim 2, wherein the second diaphragm (D2) comprises a central orifice (O) through which photons are extracted from the photon

source and pumping holes (t) distributed around the central orifice, the diameter of the pumping holes (t) being chosen to prevent microwaves injected into the cylindrical chamber (CH) under a vacuum from leaving the chamber, the number of pumping holes being chosen in relation with the hole diameter to set up a pressure value of the first constituent (g1) and/or the second constituent (g2) in a zone of the chamber located close to the second diaphragm.

4. Photon source according to claim 3, wherein the second diaphragm (D2) is made of a conducting material and is polarised either to capture ions on impact zones (E1, E2, E3) and to transfer electrons to the plasma, or to capture electrons on impact zones (E1, E2, E3) and to transfer ions to the plasma.

5. Photon source according to claim 1, wherein Q additional diaphragms (D3, D4, D5, D6) are placed between the first and the second diaphragms such that the chamber is divided into Q+1 zones.

6. Photon source according to claim 5, wherein each of the Q additional diaphragms (D3, D4, D5, D6) comprises an aperture with a size greater than a cut-off wavelength of microwaves injected into the chamber.

7. Photon source according to claim 6, wherein the shape of the aperture of each of the Q additional diaphragms is such that it does not intercept the lines of a magnetic field present in the chamber, thus

leaving plasma particles free to circulate between the Q+1 zones.

8. Photon source according to claim 5, wherein at least one additional diaphragm (D3, D4, D5, D6) is made from a conducting material and is polarised to capture or to transfer ions or electrons to the plasma.

9. Photon source according to claim 5, wherein the first constituent (g1) and/or the second constituent (g2) are inserted into at least one of the Q+1 zones of the chamber.

10. Photon source according to claim 1, wherein the chamber is in a truncated cone shape and participates in the means of setting up the pressure gradient.

11. Photon source according to claim 1, wherein pumping means (P) participate in the means of setting up a pressure gradient.

12. Photon source according to claim 1, wherein means (K) introduce additional electrons into the chamber (CH).

13. Photon source according to claim 1, wherein the first constituent (g1) and/or the second constituent (g2) is a gas or a metal vapour.

14. Photon source according to claim 1, wherein a magnetic structure that participates in the multicharged ion plasma source comprises two cylindrical magnetic structures ([3,4], [5,6]) with axial confinement of the magnetic field and a cylindrical magnetic structure ([7,8]) with radial confinement of the magnetic field that surrounds the chamber (CH) and that is located between the two cylindrical magnetic structures with axial confinement, a first cylindrical magnetic structure with axial confinement being located at a first end of the chamber and the second cylindrical magnetic structure with axial confinement being located at a second end of the chamber where the photons are extracted from the source.

15. Photon source according to claim 14, wherein at least one additional cylindrical magnetic structure with axial confinement ([9,10], [11,12]) is located between the two cylindrical magnetic structures with axial confinement located at the two ends of the chamber (CH).

16. Photon source according to claim 15, wherein the cylindrical magnetic structures with axial confinement and the additional cylindrical magnetic structure with axial confinement are composed of superconducting coils.

17. Photon source according to claim 16, wherein the cylindrical magnetic structure with radial confinement is composed of superconducting coils.

18. Photon source according to claim 17, wherein the superconducting coils that form the cylindrical magnetic structure with radial confinement are located inside the superconducting coils that form magnetic structures with axial confinement.

19. Photon source according to claim 17, wherein the superconducting coils that form the cylindrical magnetic structure with radial confinement are outside the superconducting coils that form the magnetic structures with axial confinement.

20. Photon source according to claim 17, wherein the superconducting coils that form the cylindrical magnetic structure with radial confinement are "racetrack" type coils.

21. Photon source according to claim 14, wherein the cylindrical magnetic structure with radial confinement is composed of permanent magnets.

22. Photon source according to claim 14, wherein the inside diameter of the cylindrical magnetic structure with axial confinement located at the second end of the chamber increases with increasing distance from the inside of the chamber towards the exit from the chamber.

23. Photon source according to claim 1, wherein wavelength $\lambda_o$ is equal to approximately 13.5 nm.